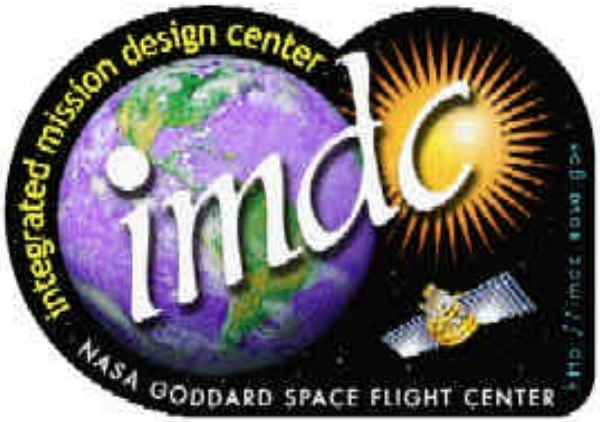
Generation X Study

Mechanical



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Mechanical Topics

- Overview
- Driving Requirements and Assumptions
- Options considered
- Selected Configuration and Rationale
- Spacecraft Configurations
- Mass Summary
- Trades / Risks / Issues & Concerns

Mechanical Overview

- Several options/configurations have been studied.
- Each have their merits depending on baseline assumptions.
- Each will be presented, their advantages and disadvantages will be discussed.

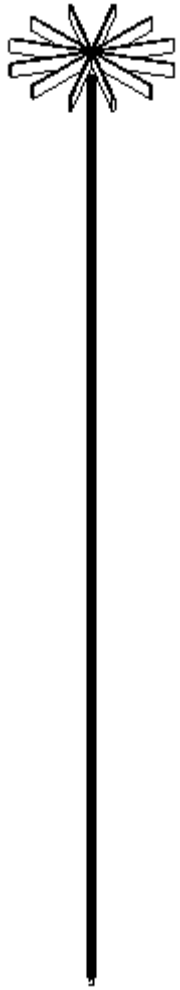
Mechanical
Driving Requirements

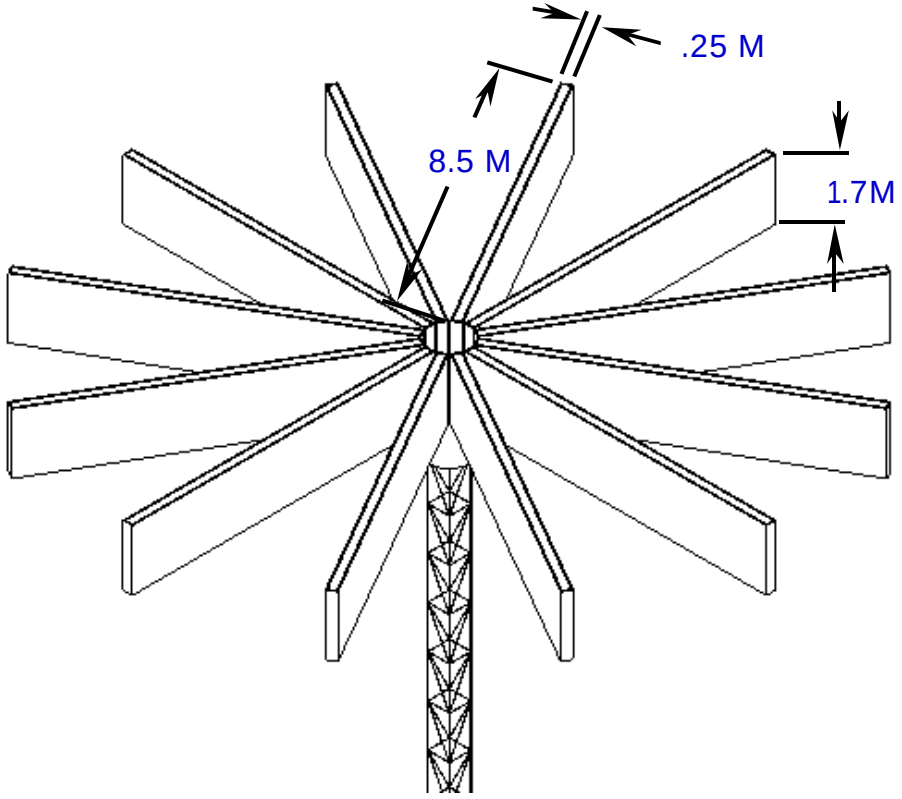
- **Challenge:**
  - Design next generation X-Ray telescope that
    - Has 25 M^2 collector (mirror) area.
    - Has a 100 M focal length
    - Provide S/C bus to house power, comm, ACS, C&DH.
  - Launch scenario:
    - Direct insertion to L2 orbit
    - Insertion of components to LEO (space station), assembly at station, transfer to L2 orbit

Mechanical
Selected Configuration and Rationale

- **Because the study is just beginning all configurations were considered.**
- **Some were dismissed quickly for obvious reasons.**
- **The others have their merits that warrant further study.**
  - These options/configurations will be presented with their advantages and disadvantages

Mechanical
Spacecraft Configurations





Option #1

- Direct insertion to L2
- Petals fold down around Bus
- Mast deploys to 100 M
- Will dimensionally fit in Delta IV shroud

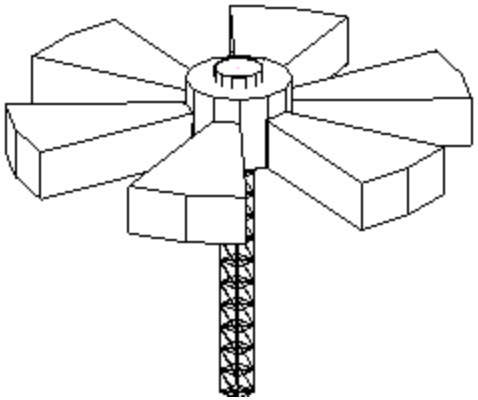
Rejected

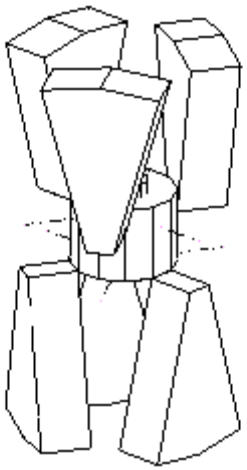
- Thermal limitations -Petals present too much exposed area for adequate thermal control

Mechanical
Spacecraft Configurations

Option #2

- Direct insertion to L2
- Delta IV launch vehicle
- 6 Petals
- Spinner, S/C bus despun
- Solar array
  - Deployed from end of collectors
- Mast deploys to 100 M





Rejected:

- Does not meet 25 M^2
- Thermal limited

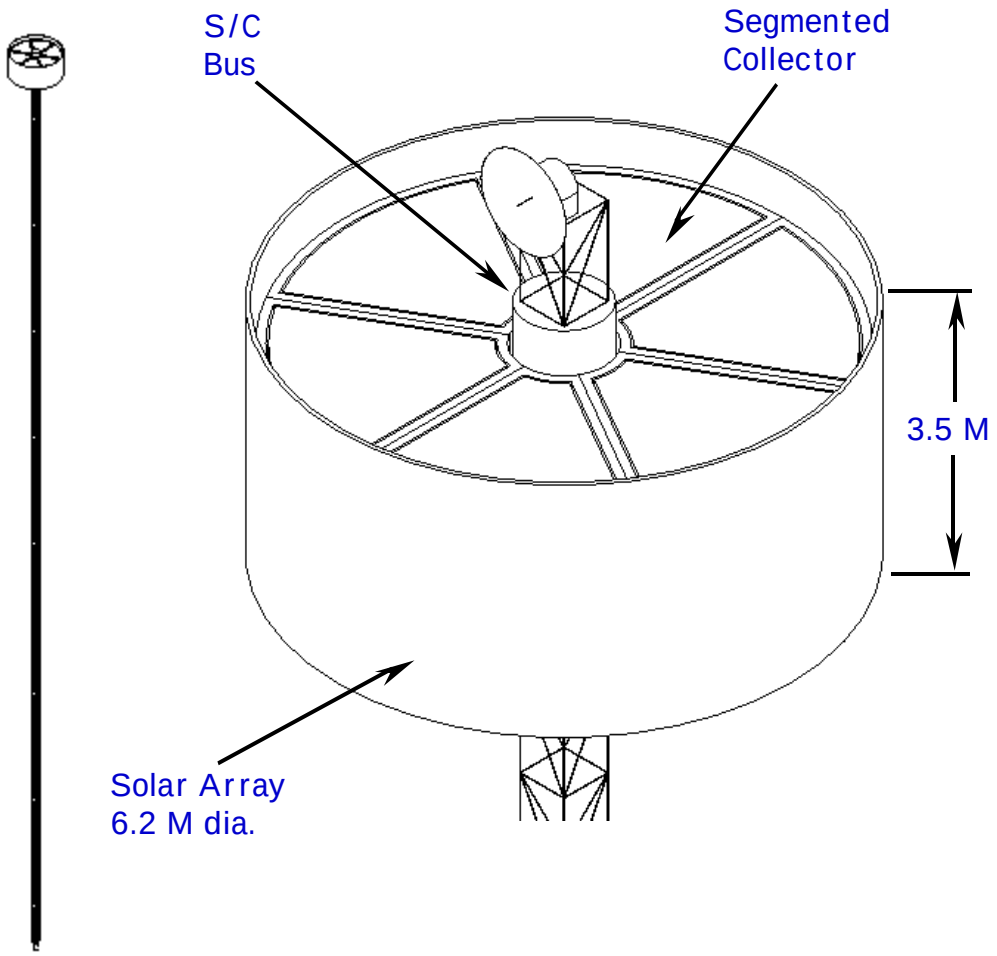
Mechanical
Spacecraft Configurations

Option #3

- Components to LEO
- Assembly and Check-out at Space Station
- Collector segments form 6 M dia.
- Solar array around collector. Also serves as sun shade for collector
- Spinner with despun bus
- Mast deploys to 100 M
- Component size will be optimized for launch vehicle

Draw-backs:

- Means of transfer to L2
  - Slow trip-
    - long dwell in radiation belt
    - soft ride
  - Quick trip-
    - chance of damage to collector
    - misalignment of collector



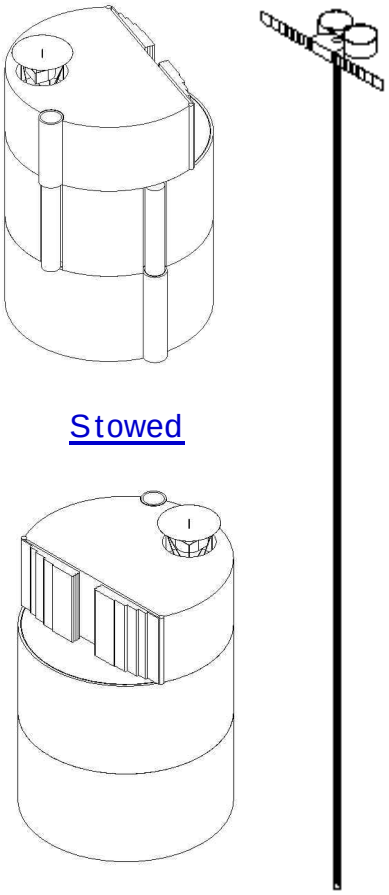
Mechanical
Spacecraft Configurations

Option #4

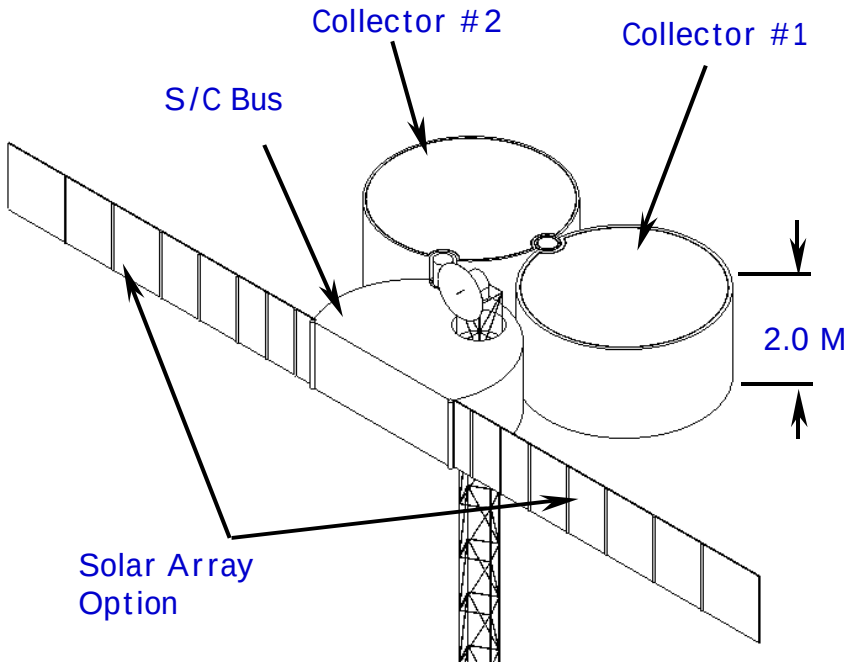
- Direct insertion to L2
- Delta IV launch vehicle
  - mass critical !!
- 3 Modules
  - 2 collectors 4M dia. each
  - 1 bus 4M dia.
- Modules will rotate and drop into place
- Solar array
  - deployed from side of bus
  - along surface of collectors
- Mast deploys to 100 M

Draw-backs:

- Mass Critical
- If shuttle is used no provisions have been made for apogee kick motor for L2 insertion



Stowed



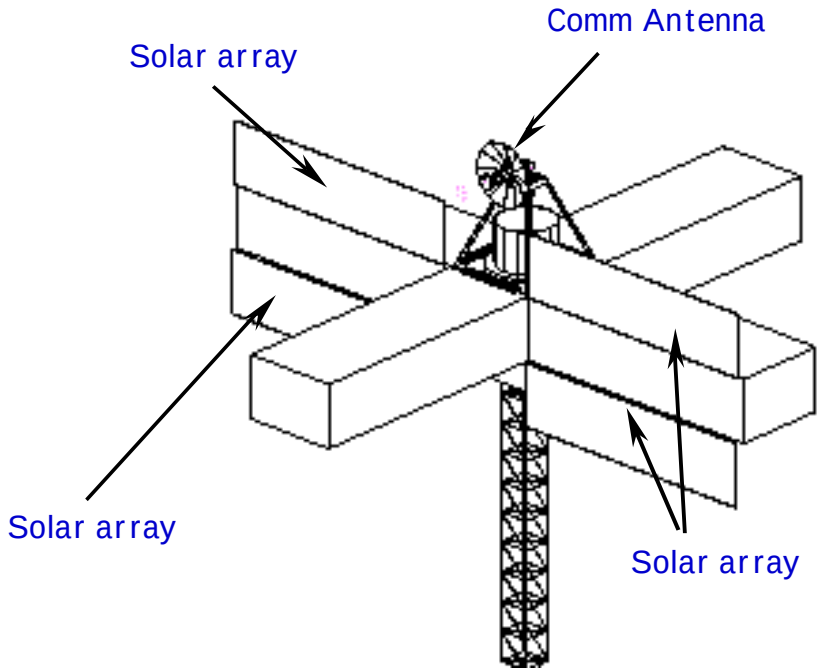
Mechanical
Spacecraft Configurations

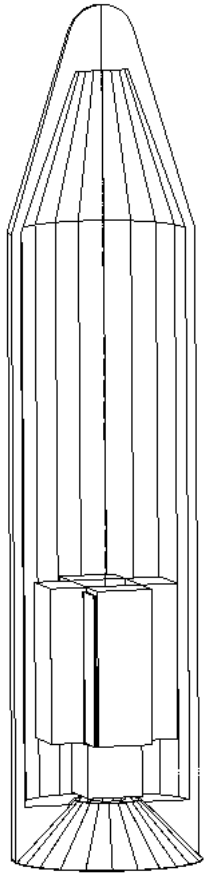
Option #5

- Direct insertion to L2
- Delta IV launch vehicle
- 4 Petals
- Solar array
  - along surface of collectors
- Mast deploys to 100 M
- Apogee kick motor incorporated

Draw-backs:

- Thermally challenging





Mechanical
Mass Summary

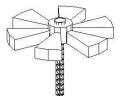
♦ Capabilities

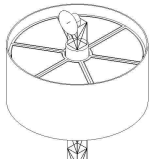
- Delta IV (heavy)
  - LEO - 20,500 kg
  - C3 = -0.7 - 7526 kg
- Atlas V (552)
  - LEO 20,520 kg
  - C3 = -0.7 - 5719 kg
- STS (shuttle)
  - LEO - 12,000 / 14,000 kg

♦ S/C Mass

- Experiment 5600 kg
- Bus 500 kg
- Sub-systems 500 kg
- Prop system (LEO to L2) 5000 kg
  (Star 63F)

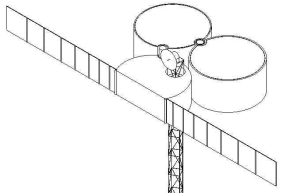
Mechanical
Trades/Risks/Issues & Concerns

- **Option #1**  **REJECTED (Thermal)**
- **Option #2**  **REJECTED (Collector area, thermal)**
- ☑ **Option #3**



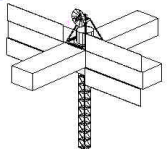
  - plus - symmetrical, thermal friendly, large solar array
  - minus - EVA involved, propulsion required

- ☑ **Option #4**



  - plus - large collector area, lower inertia, adjustable alignment
  - minus - complex deployment, mass

- **Option #5**



  - plus - simpler deployments, symmetrical
  - minus - thermally challenging, sun shielding